

REMARKS

This paper responds to the Office Action mailed on June 9, 2004.

Claims 7, 20, and 28 are amended, as a result, claims 3, 5, 7-42, and 65 remain pending in this application. Applicant requests entry of these amendments because they place the case in condition for allowance, or alternatively reduce the number of issues upon appeal. No new matter has been added, specifically the removal of the exposed portions of the seed layer by oxygen plasma may be found in the specification at least at page 5 line 11, and at page 12, line 20, as well as in original claim 30.

Reservation of the Right to Swear Behind References

Applicant maintains its right to swear behind any references which are cited in a rejection under 35 U.S.C. §§102(a), 102(e), 103/102(a), and 103/102(e). Statements distinguishing the claimed subject matter over the cited documents are not to be interpreted as admissions that the documents are prior art.

§103 Rejection of the Claims

Claims 3, 5, 7-42, and 65 were rejected under 35 USC § 103(a) as being unpatentable over Tan et al. (U.S. Patent No. 6,372,622) in view of Matsuda et al. (U.S. Patent No. 6,403,481). Applicant respectfully traverses this rejection. The Examiner has the burden of establishing a prima facie case of obviousness under 35 USC § 103(a), and the test is whether one of ordinary skill in the art, with the suggested references in front of him, would be motivated to make the proposed combination. Applicant respectfully submits that the Office Action, in paragraph 3, erroneously states that the cited reference of Tan discloses *depositing a seed layer including a thin film of Palladium (Pd) or Copper (Cu) on a semiconductor substrate 10 (see col.3, lines 30-53)*, and thus the feature of the independent claims of either a thin <15 nm seed layer, or a discontinuous island structure is obvious over the cited references. Applicant respectfully submits that one of ordinary skill in the art would understand that the barrier layer 14, described in Tan as being of titanium-tungsten or of titanium-tungsten nitride, is not a thin seed layer or a discontinuous seed layer. Applicant respectfully submits that one of ordinary

skill in the art would understand that the layer 14 in Tan is a continuous thick layer which prevents contact and metallic inter-diffusion of the copper 30 and the aluminum bonding pads 12, and would not be motivated to use such an inappropriate continuous thick structure as the claimed thin electroless plating seed layer. Thus the Office Action fails to show motivation to combine the cited documents.

The Office Action uses the Matsuda reference to show that electroless plating, the thickness and the discontinuity of the seed layer are known in the art. Applicant respectfully submits that one of ordinary skill in the art would understand that the plating film 55 is continuous as shown in the figures and as stated in Matsuda's specification at least at column 5, line 46, wherein it states that the TaN film 12 is *uniformly formed on the silicon substrate 11 as a continuous film*, and at column 6, line 64, wherein it states that the TiN film 55 is formed with CVD which *allows forming a continuous film even if the substrate surface has a step*. Applicant respectfully submits that one of ordinary skill in the art would understand that the described structure is a continuous metal film barrier layer with islands of a different metal formed on the surface of the first metal to act as nucleation sites, and that the describe structure is not a thin or discontinuous seed layer, such as recited in the present invention.

Applicant respectfully submits that one of ordinary skill in the art would understand either cited reference as describing a continuous metal barrier layer, and not a thin or discontinuous seed layer as recited in the independent claims. Since both documents describe a plating layer on continuous metal barrier layer, Applicant submits that neither document could describe or suggest a thin/discontinuous seed layer on a semiconductor substrate.

Applicant further submits that neither of the cited documents describes or suggests the feature of electroless plating to a top surface of a photo resist layer, as is found in the present dependent and several of the independent claims. Applicant respectfully submits that the cited reference of Tan does not describe or suggest that the electro plated copper layer 30 should be plated to the top of the photo resist layer 20, and further submits that the cited Tan reference teaches away from the claimed arrangement by describing the solder plated bumps 60 as using the first photo resist 20 as part of the plating mask. The cited reference of Matsuda does not use any sort of photo resist as the plating mask, but rather uses the dielectric 51 as the plating mask. Therefore, Applicant respectfully submits that the Office Action fails to provide the required

showing of motivation to combine the cited documents, and even if the combination were made it still results in a different structure from the claimed structure.

Specifically, Applicant respectfully submits that independent claim 7 is patentable over any combination of the cited documents of Tan and Matsuda because the suggested combination of documents neither describes nor suggests at least the claimed feature of a thin seed layer of Pd or Cu, or of removing the photo resist and seed layer using oxygen plasma. The cited references are seen as teaching thick/continuous barrier layers of various nitride materials and the Examiner admits that there is no discussion of oxygen plasma. Applicant submits that there is nothing to suggest the removal of the seed layer using oxygen plasma. Claims 3, 5 and 65 depend from claim 7 and are thus seen as being in patentable condition at least as reciting additional limitations over a patentable base claim. Applicant respectfully requests that this rejection be withdrawn.

Applicant respectfully submits that independent claim 8 is patentable over any combination of the cited documents, Tan and Matsuda, because the suggested combination of documents neither describes nor suggests at least the claimed feature of a thin film having a discontinuous island structure on a semiconductor substrate. As discussed in depth above, the cited documents have a continuous metal film and not a discontinuous film on a semiconductor substrate. Claims 9-12 depend from claim 8 and are thus in patentable condition at least as reciting additional limitations over a patentable base claim. Applicant respectfully request that this rejection be withdrawn.

Applicant respectfully submits that independent claim 13 is patentable over any combination of the cited documents because the suggested combination of documents, whether taken alone or in any combination, neither describes nor suggests at least the claimed feature of filling the first number of via holes to a top surface of the first patterned photoresist. As discussed above the Tan reference teaches away from plating to the top of the photoresist layer, and the Matsuda reference does not use photoresist as the plating mask. Claims 14-19 depend from claim 13 and are thus in patentable condition at least as reciting additional limitations over a patentable base claim. Applicant respectfully request that this rejection be withdrawn.

Applicant respectfully submits that independent claim 20 is patentable over any combination of the cited documents because the suggested combination of documents, whether

taken alone or in any combination, neither describes nor suggests at least the claimed feature of forming copper vias to a top surface of the first photoresist layer. As discussed above with reference to the rejection of claim 13, the Tan document teaches away from plating to the top of the first photoresist, and Matsuda does not teach photoresist as the plating mask. Claims 21-27 depend from claim 20 and are thus believed to be in patentable condition at least as reciting additional patentable limitations over an allowable base claim. Applicant respectfully request that this rejection be withdrawn.

Applicant respectfully submits that independent claim 28, and dependent claims 29-33, are patentable over any combination of the cited references for many of the same reasons given above with reference to claim 20. The suggested combination of references fails to describe or suggest plating to the top of the photoresist, and Applicant submits that the suggested combination of references teaches away from the claimed arrangement. Applicant respectfully request that this rejection be withdrawn.

Applicant respectfully submits that independent claim 34 is patentable over any combination of the cited references because they do not describe or suggest at least the combination of features of a thin seed layer of Pd or Cu, depositing a second seed layer and using a patterned photoresist mask to plate a second number of conductor lines. Applicant notes that the Examiner states in paragraph 4 of the outstanding Office Action that the combined teaching of Tan and Matsuda the steps of a second patterned photoresist level defining conductor lines. Therefore, Applicant respectfully submits that it is not possible for independent claim 34, and consequently dependent claims 35-42 which depend therefrom, to be obvious over Tan in view of Matsuda. Applicant respectfully request that this rejection be withdrawn.

In view of the above discussion, Applicant respectfully submits that claims 3, 5, 7-42, and 65 are patentable over Tan in view of Matsuda, and requests that this rejection be withdrawn.

Claims 13-42 were rejected under 35 USC § 103(a) as being unpatentable over Tan et al. in view of Matsuda et al. and Simpson (U.S. Patent No. 6,197,688). Applicant respectfully traverses this rejection. The Office Action uses the Simpson reference to supply the missing features of the suggested Tan and Matsuda references of forming conductive vias and them forming conductive lines. Applicant submits that the cited reference of Simpson does not

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remedy the above noted failing of the combination of Tan and Matsuda, and is seen as describing a method which does not use photoresist as the plating mask, nor does Simpson plate to the top of the non-existent photoresist layer, or even to the top of the trench as may be seen by the use of chemical mechanical polishing (CMP) of the plated metal 34 in figure 3, to form the metal conductors 38 in figure 4. There is further discussion of CMP at column 4 line 13.

Since the suggested combination of references fails at all points to plate to the top of the masking element, whether oxide or photoresist, and further fails at all points to describe or suggest the use of a thin or discontinuous seed layer for electroless plating to the top of the photoresist layer, then Applicant submits that the Examiner has failed in the obligation to provide any reason why one of ordinary skill in the art would be motivated to make the suggested combination of references. Applicant further submits that since none of the references, whether taken alone or in any combination, suggests the above noted combination of features, then even if the combination of references were to be allowable the result would still not have all of the features of the claimed invention. Applicant respectfully requests that this rejection be withdrawn.

Applicant further incorporates all prior responses to preserve all issues for appeal.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney (612) 349-9587 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

KIE Y. AHN ET AL.

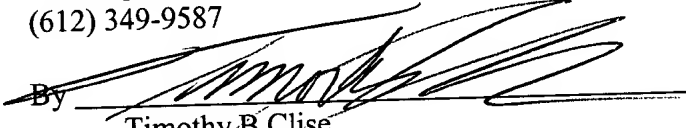
By their Representatives,

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23 July '04

By


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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop AF, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on this 23 day of July, 2004.

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